

Game, Not Fight: Change Climate Change!

Simulation & Gaming

44(2-3) 272-301

© 2013 SAGE Publications

Reprints and permissions:

sagepub.com/journalsPermissions.nav

DOI: 10.1177/1046878112470541

sag.sagepub.com



Gilbert Ahamer¹

Abstract

This article argues that in the long run *gaming* (i.e., managing unstable equilibria while maintaining societal sustainability) serves better as a strategy against the undesired effects of global change (GC) than *fighting* (i.e., understanding only one's own standpoint, but not the standpoint of one's adversaries). GC is believed to be driven by a *bundle* of drivers, some of which are global long-term trends that are almost impossible to change. Climate change is only one component of this syndrome. GC exerts a *bundle* of effects on society. Given this interlinked and systemic character of GC, an explorative, reflexive, *dialogue*-driven strategy allowing for continuous adaptation, rather than a *theory*-driven predesigned solution, is advocated. Taking *roles* allows actors to perceive the paradigms and perspectives of adversaries. Hence, game-based (but structured) procedures allow the taking of adversarial positions without being compromised. As an example of such procedural structuration, the negotiation game SURFING GLOBAL CHANGE (SGC, © Gilbert Ahamer) published earlier in this journal is recommended. The social dynamics of SGC is graphically analyzed. SGC was implemented three dozen times with students within several university curricula such as Environmental Systems Science or Global Studies training developmental cooperation. Through changing roles, SGC allows one to walk through the complex argumentative landscape while gaming. This article proposes several conclusions to the way in which *gaming* should respond to the complex patterns of GC.

Keywords

adaptation, behavior patterns, changing perspectives, climate change, complexity, consensus, consensus building, constructivist paradigm, dialogue, distributed actors, drivers, dynamic processes, fighting, game design, gaming, global change, global realities, institution building, intercultural understanding, interdisciplinarity, interparadigmatic understanding, mitigation, multiperspectivism, multiple drivers, paradigmatic shift, rhythmization, role-play, roles, societal learning, syndrome, trends, underdefined problems

¹Austrian Academy of Sciences, Salzburg, Austria

This article is published as a part of the symposium: *Climate Change and Simulation/Gaming*

Corresponding Author:

Gilbert Ahamer, Austrian Academy of Sciences, GIScience, Schillerstrasse 30, 5020 Salzburg, Austria

Email: gilbert.ahamer@sbg.ac.at

VISIT...

LANZAROTE
Caliente.COM

You want to fight climate change? Then in order to be successful, you should game rather than fight!

Let us understand *global change* (GC) as a complex and dynamic process with distributed actors and contributors. As a consequence, an appropriate strategy to effectively answer its partly threatening results will have the same structure: complex, interconnected, and distributed across actors, sharing only a limited set of common perspectives.

Change your perspectives, and your values will change. Your patterns of behavior, your society, and ultimately *climate change* will then also start to *change*. Is this a vain hope or a promising approach?

The methods must suit the issue. Global climate change is complex, systemic, dynamic, dispersed, underdefined, and paradigmatically shifting, depending on the perspectives of the actors involved. Its dynamic behavior means meandering and toggling between sets of systemic optima, suboptima, or whatever the global population has been used to. Within a larger stream of evolution, GC and climate change (CC) have resulted from collective values that changed as a result of their own emergence. The values by which we assess GC are coevolving, shaken up, and disputed among the affected stakeholders.

Perception of complexity is a societal task and a social process: describe and visualize it. Visualization allows understanding more instantaneously—especially when visualizing not only in the geometric and geographic space, but also in the *space* of opinions, roles, perspectives, visions, and paradigms. This is the approach of SURFING GLOBAL CHANGE (SGC): first to use tables and web postings for each role as a physical correlate and substrate, but later players become independent of such auxiliary means. Here, cognition can also be understood as pattern recognition of complex interactions.

Role-play allows participants to take on the perspectives, roles, views, and to follow paths through complex patterns of realities. The web-based negotiation game SGC mentioned in this article is a structure of rules using the time axis for experiencing (social and factual) connectedness. By means of role-play, it becomes possible to perceive *the other*, namely, what one has missed.

Introduction

What Is Global Change?

GC is a very complex evolutionary transition of both nature and humanity, entailing a changed perception of these global realities. Climate change is but one part of GC.

GC is driven by a *multitude of drivers* (Figure 1, above right), commonly described by different disciplines of (natural) science. GC is often called a *syndrome* (Eisenack, Lüdeke, Petschel-Held, Scheffran, & Kropp, 2006), that is a concurrent association of several changes in meaning, paradigms, lifestyle, economy, energy, land use, and climate. Consequently, GC requires an interdisciplinary discourse in order to sufficiently

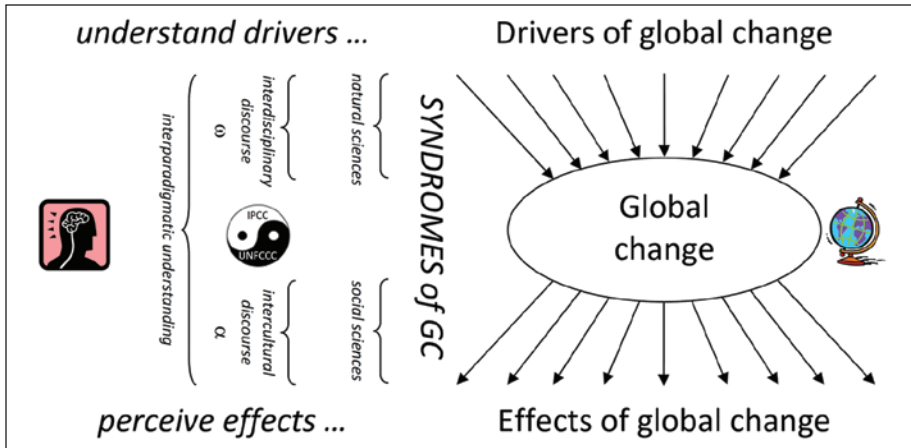


Figure 1. Perception (left) and reality (right) of the syndrome of GC.

Note: GC = global change; IPCC = Intergovernmental Panel on Climate Change; UNFCCC = United Nations Framework Convention on Climate Change. Perception provides feedback to reality through *learning*. The GC-related global institutions IPCC and UNFCCC are symbolized as complements because of their complementing views on facts versus acts

master and understand GC's components and their interactions. Moreover, GC exhibits a *multitude of effects* (Figure 1, below right, for example, climate impacts, migration, reconfiguration of states, uneven development) on various walks of life, more accurately described by different social science disciplines. Because various population groups and stakeholders are affected by GC, their views on GC have to be absorbed in order to reach complete understanding. In the following, we will refer to this type of discourse as *intercultural* (Ahamer, Kumpfmüller, & Hohenwarter, 2011) because it respects the concerns and perspectives which stem from several *cultures of understanding* (e.g., several disciplines of social science).

In this article, the combination of *interdisciplinary* and *intercultural* understanding is called *interparadigmatic* understanding (far left in Figure 1 representing the perception side as opposed to the factual, physical reality side at right). For example, for those readers familiar with GC institutions, the yin-yang symbol carries the names of two global institutions dealing with climate change: Intergovernmental Panel on Climate Change (IPCC) representing natural science dealing with the *world of facts*, and United Nations Framework Convention on Climate Change (UNFCCC; *world of perspectives* and further, hopefully, *world of acts*) implementing practical political answers on the part of humanity to counteract the undesired effects of global climate change.

This article claims that interparadigmatic perception is essential for coping suitably with GC.

This article sets out to (a) develop the necessity, (b) deliver quality criteria, and (c) outline a proposal for both *individual and societal learning* on a global scale,

including not only interdisciplinarity, but also interculturality, that is, appreciation for diverse cultures of understanding and the integration of opposing paradigms.

Why Role-Play Helps in Changing Globally

One motivation of this article is concerned with having sufficient quality suggestions for how to deal with GC. From the perspective of the author, in the past decades, the multitude of local, national, and global efforts have been successful only to a very limited extent in terms of designing climate protection plans. One possible reason for this is that the traditional climate protection approach did not sufficiently account for the complexity of this multilevel issue. One of the crucial questions is how much relative emphasis to put on the two main strategies of *mitigation* versus *adaptation*. These opposites can be described by the notions of withstanding versus understanding in the following paragraphs.

To *perceive and understand* optimally GC's *complexity* is a prerequisite for effectively *altering* GC to the degree in which it is possible. What is desired are paths for how to walk through the intercomplex (i.e., both interdisciplinary and intercultural) argumentative landscape allowing for the assumption of varying perspectives without experiencing social discomfort. In role-play, taking a contrary role, for example, the opposite of what a player stands for in real life, allows one to perceive the unseen, forgotten, hidden, and missed traits of realities. Role-play allows for the perception of others' paths and resulting perspectives optimally, quickly, thoroughly, and succinctly. Hence, the concept of role-play should be optimized in a way that facilitates understanding of the *other* (i.e., the *nonego*) by offering (a) a clearly structured, (b) an easily intelligible, and (c) a flexibly adaptable social process as a temporal pattern.

Let us symbolically describe and visualize the possible multitude of human actions by a *state space* of human behavior, just as modern theoretical physics, mathematics, game complexity theory, or quantum mechanics (Feynman, 1970) conceived state spaces in which concrete actions assume values represented by vectors.

The unit vectors of human behavior α and ω (invented here) point in two directions (Figure 2):

- (α) act/withstand GC—change globally!
- (ω) ω nderstand GC—global change?

The selection of the symbols α and ω stresses that the *alphabet of concrete communicative action* lies in between these two extremes.

In recent decades, the degree to which climate protection versus climate adaptation has been appropriate has come under discussion (Kane & Shogren, 2000). Perpetual questioning of GC and endless research on its scientific details (ω) would result in walking in a circle (symbolized by the traditional sign for circular movement in physics, the ω in Figure 2). Only stepping out of pure reflection and entering into action (α) leads out of the self-centered, continuous generation of *scientific results*

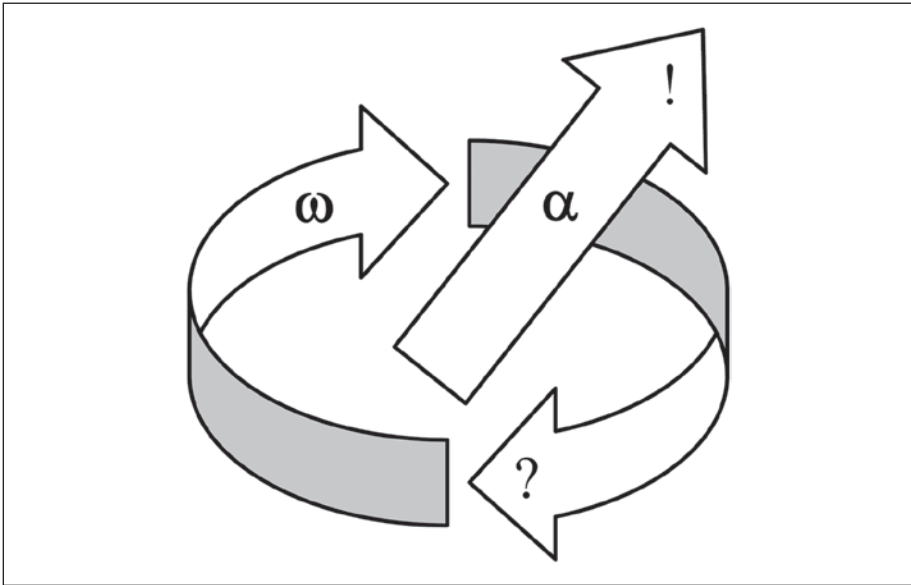


Figure 2. Unit vectors of human behavior: alpha means to act, omega means to understand.

(Cynical Geographers Collective [CGC], 2011; Herbert, 2010; Kriz, 2009; compare Niebuhr, 1938).

Figure 3 visualizes that a balance between (α) withstanding and (ω) understanding GC should and will be achieved. Responsibility therefore translates into creating a suitable procedure for finding an appropriate point of equilibrium that ultimately accounts for all disciplines, but also for all stakeholders' viewpoints. As one practical example of the necessity to include opposing standpoints, the call for climate change measures (i.e., cutting CO₂ emissions, for example, through tempering industrialization) is often understood as prolonged neocolonialism with the perceived motivation of limiting the economic success of so-called "developing nations" (The Telegraph, 2009).

It becomes obvious that the structure of the GC issue requires continuous adaptation to the system of values of the affected population groups, while these values continuously undergo evolutionary changes (Ahamer, 2008a; Greco, Branca, & Morena, 2011). In addition (and in order to hint at the robustly developing field of Geographic Information Science [GIS]), both drivers and effects of GC are regionally diverse. This might result in a call, among others, to enrich gaming by Public Participation GIS (PPGIS; Jekel, 2007; Vogler, Ahamer, & Jekel, 2010) because of the regional diversity of both the problem and its solutions (Eisenack, 2009; Kriz, 2000; Reckien & Eisenack, 2010; Reckien, Eisenack, & Lüdeke, 2011; Reckien, Ewald, Edenhofer, & Lüdeke, 2007).

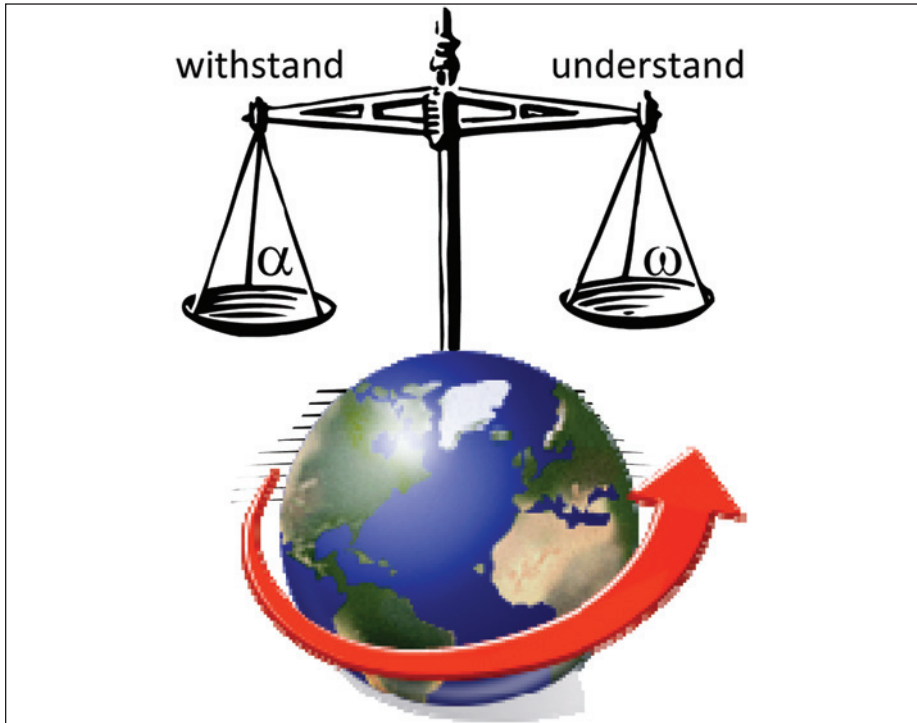


Figure 3. The global balance between understanding oneself and others.
Note: Acting/withstanding and understanding form a managed equilibrium between fighting and adapting.

GC Kinematics: Coevolution

A study of the long-term behavior of the global techno-socioeconomic sphere (Ahamer, 2004) shows that it changes in an evolutionary manner (called *trends*), thus representing an evolving framework of conditions for human action (driven by the above-mentioned sphere's *visions*). Because socioeconomic long-term modeling is highly dependent on underlying decisions for worldviews and model types (Welsch & Eisenack, 2002), the author suggests a (graphical) analysis of de facto developments instead of impressing reductionist theories on complex global history. Figure 4 above shows the general relationship between challenging trends of GC and the corresponding response by societies, and below the concrete quantitative evolution of the relative share of nine gross domestic product (GDP) sectors in all global economies which symbolize evolutionary structural changes in societies (social aspects of GC). The small (global) surfer symbolized in this figure experiences the impulses of the waves, resulting from social and evolutionary forces.

Because humanity is situated on such moving waves, strategies are also subject to continuous change. Hence, it is appropriate to speak of a *coevolution of problem*

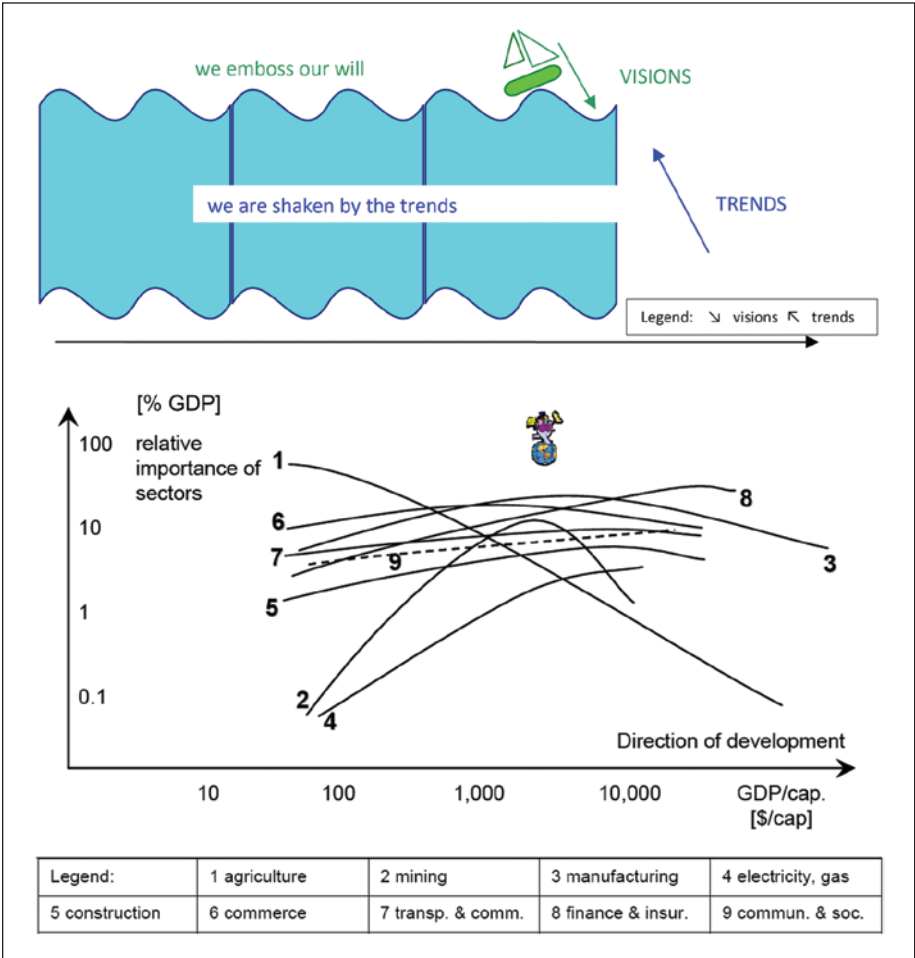


Figure 4. The surfer (above) finds equilibrium between steering and adjusting, which is a symbol for riding on the waves of global techno-socioeconomic evolution (below), expressed quantitatively by structurally shifting shares of GDP that measure economic activity. Note: GDP = Gross Domestic Product.

space and solution space, a term that has been used for years in a quite unconventional branch of science, namely design science (Badke-Schaub, 2004). Based on earlier quantitative experience in climate protection modeling, this article proposes to use a so-called “Kon-Tiki” strategy of *sailing with the winds of GC*. This means benefiting from climate-friendly global trends such as the dematerialization of the economy (e.g., Kopainsky, Pedercini, Davidsen, & Alessi, 2010; Nakićenović, 1996). Otherwise, the task of climate protection is thought to be unachievable given the tremendous reduction necessities, as has been suggested by science for a long time.

Experiences from international cooperation indicate a necessity: The generation of a coherent political will and associated mutual approximation of democratic political systems is only possible through consensus, not through coercion, as was shown by the example of the recent EU enlargement (e.g., Ahamer, 2008b), meaning successful societal consensus building, organizational learning, and institution building (Bots, Wagenaar, & Willemse, 2010; Kriz, 2003).

Learning = Living

This article attempts to add on to earlier and established learning theories (LT; Argyris, 1993; Argyris, Putnam, & McLain Smith, 1985; Argyris & Schön, 1978; Dewey, 1966; Kolb, 1984; LT, 2012; Rogers, 1969) by selective statements. In the present text, life is principally understood as a continuous learning endeavor:

Living = learning creates reality.

Living = creation of structures

Learning means to act differently, not only to perceive differently than beforehand (else reality would not change).

Learning is understood as re-structuring (of our, i.e. the learners' way of facing reality / to interact with reality & others / to shape-form-build realities)

Consciousness is understood as perceived life.

History is the illusion of reality re-created generation after generation. (cited from Pierre Corbeil by Crookall, 2009, p. 295)

Consequently, it may prove valuable to think about optimal design for such learning. In the case of GC, opening one's own personality toward the *other* is the key (Moser & Moser, 2005). In the present article, the notion of *design* is expanded to *social design*, meaning design of social procedures.

Which Methods Do GC Call for?

The characteristics and dynamics of GC are more complex than those of traditional environmental protection. Hence, the tools and methodologies have to match more ample requirements (Table 1).

Global climate change is complex, systemic, dynamic, dispersed, underdefined, and paradigmatically shifting, depending on the perspectives of actors. Its dynamic behavior means meandering and toggling between sets of optima, suboptima, or what the global population has been used to. Within a larger stream of evolution, GC and

Table 1. Challenges by Global Change and Responses by Simulation/Gaming.

Item: Systemic characteristic	Challenge: Global and climate change	Response: Simulation/gaming
CO ₂ emitters— . . . — temperature and precipitation changes: The reality of GC is seen through science and sociology	<i>Multiple drivers—multiple effects</i>	Incorporate views of various emitting industries and of regional stakeholders benefiting or suffering from CC
Climate protection ⇔ adaptation	<i>Withstand ⇔ understand</i>	Balance strategic approaches
Increased scientific clarity increases awareness and scientific efforts	<i>Coevolution (of economic values and ethical values)</i>	Circular procedure of expressing and hearing standpoints in gaming
More disciplines than usual Facts are both effects and causes	<i>Complex Systemic</i>	Traditional science insufficient Iterative communication patterns
Circular feedback loops enhance or decrease process dynamics	<i>Dynamic</i>	Game dynamics follow what is relevant, not what is logical
Distinct actors follow their diverse, inherent motivations	<i>Distributed</i>	Roles can represent all actors across a landscape of interests
Decisions under uncertainty, incomplete knowledge of facts	<i>Underdefined</i>	Repeated reconsideration of opposed perspectives
Weighing factors for unsure components, moving societal targets	<i>Paradigmatically shifting</i>	Discourse incorporates both facts and values used to assess facts
Traditional science focuses on the <i>factually correct</i> truth	<i>Depending on the perspectives of the actors</i>	Not only approximating the one truth, but balancing several truths
Mathematically speaking, the global system follows an erratic path while switching from one (climatic, social, . . .) optimum to another, including revolutions	<i>GC's dynamic behavior means meandering and toggling between sets of optima, suboptima, or what the global population has been used to</i>	Syndromes of worldviews enter into structured interaction and mirror chaotic reality. Ultimate criterion for suitability of solutions is the actors themselves
Through increased understanding of global change, peoples' sense of responsibility that humanity creates its own framework conditions for living has been strengthened. Actions are increasingly judged for their effects on long-term conviviality	<i>Within a larger stream of evolution, global change and climate change have resulted from collective values that changed as a result of their own emergence. The values by which we judge global change are coevolving</i>	Along with gaming, both perspectives and their societal assessments are likely to be subject to convergence. The social value and desire to cooperate exerts an influence on the path of the gaming process. Gaming interactions favor consensus

Note: The sign ⇔ denotes a field of tension defined by opposites. These observations are derived from the author's earlier work experience in the field and aim at defining criteria for successful gaming for global change. The term gaming is understood as defined on the website of this journal (*Simulation & Gaming*, 2012); analysis of examples for gaming is provided by Ahamer (2004a).

climate change have resulted from collective values that changed as a result of their own emergence. The values by which we judge GC are coevolving, shaken up, and disputed among the affected persons.

Dealing suitably with GC should rely on mainly *cooperative social action* (as against competitive action); the importance of which is not only underlined by pedagogics (Brown & Ciuffetelli, 2009), didactics, and political economy (Novy, 2012; Oxfam, 1999), but recently also by brain research: Bauer (2007) stated that on the cerebral level, lasting individual satisfaction stems from successful personal cooperation, not from success in competition.

The case study for game-based learning presented here is the five-level negotiation game SGC, the roles of which have been presented earlier in this journal by its author and copyright holder (Ahamer, 2006). Because it would exceed the available number of pages to explain and analyze SGC in this article, the appendix provides a list of suggested literature where analyses of SGC have been carried out.

Criteria for Successful Learning Design Through Gaming

This title reflects the main interest of this article: How does one design gaming for learning given GC? Looking at realities and work experiences (e.g., compiled as appendix) in a new manner allows the proposal of new worldviews—and as such is an intrinsic task of science in the author's view.

What Does Gaming Mean?

What is gaming? A continuous shimmering of situations, an instable equilibrium with (mathematically speaking) shallow local optima, just as in football where the distribution of players on the field is continuously changing thus providing players with a changing framework of conditions for their gaming strategies.

Gaming entails a continuous change of viewpoints and standpoints, and hence the perceptions of realities. This perpetuated change of situations, resulting targets, and strategies boosts the number of potential constellations for facilitating successful *clutching*. This means that learners are prompted to invest themselves into the learning situation and become active as a result of their own motivation.

Just as in politics (or in climate change), the structure of the playing field itself is the result of the game in its previous phases. Such a logical structure creates a self-referential system. Dissolving such a structure into a process unfolding over time, an iterative circle of statement and criticism, of authoring and reviewing, and of proposition and consensus seems most suitable.

Advanced gaming may even mean to *play with rules*, similar to when children have played enough with a game set and start to use the field and figures in a very different manner for their own conceptual targets. At this stage, gaming even means the *generation of own rules* and laws which then represent the structural basis for further growth.

In this light, a theory of gaming means an iterative reality, not formally deterministic. Analogously, in the mathematical sense, it means a path integral that does not find

its way back to its origin (and—mathematically speaking—does not have a potential function). History is path dependent, hence not a priori computable. We see that well-known traditional *Game Theory* is not a *Theory of Gaming* (compare Klabbers, 2006).

How should gaming and learning processes be steered? By allowing for autopoietic self-steering during learning and by enhancing it in two respects:

- Anatomy of setup in gaming = game architecture = structure in *space*
- Anatomy of process structure in gaming = game dramaturgy = structure in *time*

Suitable gaming, hence suitable game rule design, should take care of both.

What Roles Are

Roles are a physicalized crutch for taking views. They are the training apparatus on which we train our (visionary) muscles. Like in a gym where you see a lot of exercise machines: Which one would you like to use? In gaming, this gym question translates as a training question: Which role do you want to play?

What a *role* does is to render more easily the understanding of other perspectives because they are taken by a physical person. In successful gaming, the participants should be sufficiently trained to see that these viewpoints exist independently of the stakeholder who may be defined—present or not.

Roles are preformed and prenamed patterns of interest and aggregates of partial views that are initially glued to each other by the relative position of the stakeholder within the landscape of interests and interactions—such is the view proposed by the author.

Like selecting an area of a town where you intend to buy property with a view to living there for many years. It predetermines your outlook and perspectives on your neighbors for a long time. You *buy the neighbors with the house*. You buy the panorama and perspectives with your new house.

Like a profession into which you enter and which you carry out for decades . . . and which predefines many of your likely interests.

In practical gaming/simulation, it is therefore of utmost importance to let the participants define the roles (in order to have them imagine the existing patterns of interest), but not to assign the roles to them. This is equivalent to drawing the map of the new landscape and to locating oneself on this map, much like when wandering through new mountain terrain.

A suitable design of a GC simulation game is rule oriented (as opposed to loyalty oriented, Kidder, 1996) and leans toward an *ethics based on negotiation* concept (i.e., teleological as opposed to deontological ethics, see Cline, 2012). The task is to arrange and manage the multiprotagonist design process when gaming—and to allocate the societal interests and social processes to gamers in their selectable roles. Hence, gaming is a helpful exercise regarding GC: how to design tools, measures, and institutions pertaining to reducing global CO₂ emissions (e.g., CO₂ trading, clean development mechanisms, and other so-called “policy measures”). Gaming should allow one to look into

the unexpected, undesired, and unhelpful side effects of these and other proposed *climate protection measures*. In any case, such perceptions of inappropriateness surface at the latest during international negotiations, even among industrialized countries, which are then forced to understand how their proposed climate protection measures counteract opportunities for *development* as perceived by southern countries.

In order to get a clear picture of the potential meanings of *roles*, let us look at roles from different sides (such perspectives are named *world* hereafter—all observations and conclusions are based on own experience, cf. appendix):

- A. From the world of persons:
 - Participants select a person's identification with a role.
- B. From the world of interests and views:
 - Roles are knowing one's own interests.
 - Patterns and aggregates of interest.
- C. From the world of facts:
 - Surveying (a) details and (b) perspectives of a real case.

Through the help of roles, gaming facilitates a shift from truth to view. Gaming helps to perceive and absorb others' views.

In a very generalized sense,

- time can be seen as the substrate for any processes
- space can be seen as an opportunity for any conscious entity to separate in the geodetic *space of places* and to individualize
- analogously, roles can be seen as localizations in the functional *space of flows* (Castells, 2001) and hence an opportunity to separate from the entirety of potential interactions.

According to the understanding of the author, the achievement of role-play does not lie exclusively in that students take a new role, but in that they leave their role as a *student* (Ahamer, 2010). This precisely activates potential energy which is usually only freed when they leap out of the campus with their diplomas in hand. Interdisciplinary university curricula such as Environmental Systems Analysis (*Umweltsystemwissenschaften* [USW], 2012) with its five specialties—physics, chemistry, geography, business administration, and economics (circles in Figure 5)—or Global Studies (GS, 2011) take such a cultural switch seriously.

In role-play, the resulting social dynamics occur on several levels simultaneously:

- knowledge level
- empathy level
- motivation level
- interaction level
- dramaturgy level
- community building level

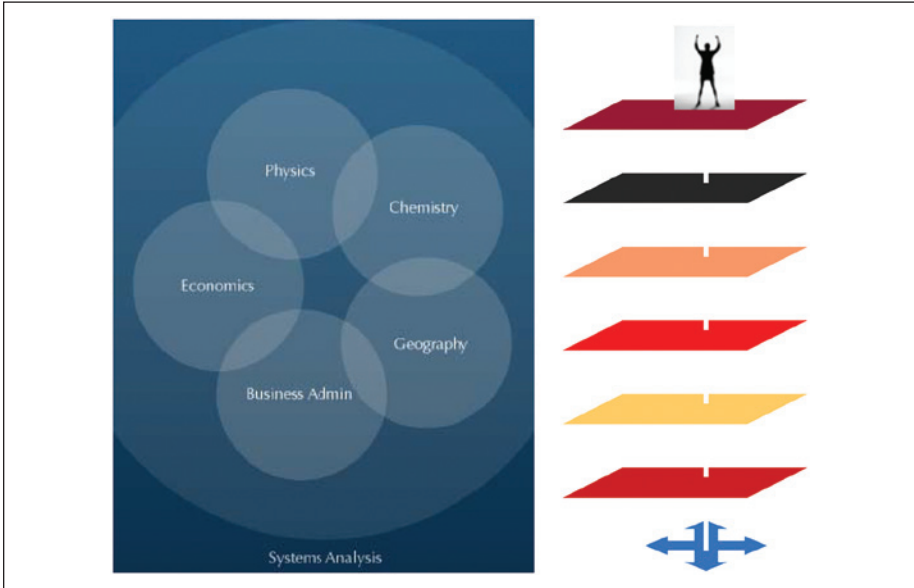


Figure 5. Levels of action are intrinsically interlinked (right), these may belong to diverse disciplines (left).

Figure 5 shows that the space-time situation of any human being forces these levels to be interlinked. *When acting on one level, a person inevitably also produces actions on another:* For example, an act of cognition affects future community building, an act of empathy affects future empathy. Such a presumed *restriction of degrees of freedom* in the state space of human action is mediated through *time* as a channel for procedures.

As a result, the art of designing gameable processes is to facilitate *optimal* results for individual and societal learning under the auspices of such a coupling of paths that unfolds on each of the individual levels. This is the ultimate target of game design, rule design, and role design.

Underdeterminism

Creation of games is an active act of designing—albeit oriented at theory (Crookall, 2010; Hense, Kriz, & Wolfe, 2009; Kriz, 2010; Kriz & Hense, 2006). The design scientists Thomas and Carroll (1979) discovered that “designers tend to treat all problems as though they were ill-defined” (p. 5). They do so by changing the problem’s constraints and goals—even if the problem was well defined. Designers will be designers even if they can be problem solvers.

Indeed, problems might even be intentionally ill defined in order to allow for gaming. Playing intentionally introduces degrees of freedom (Restrepo & Christiaans, 2004) during interaction and action; these degrees of freedom allow for additional vision and perspective. Hence, playing facilitates learning. Mathematically or systematically speaking, by tipping the deflection of the system’s state, the gamers determine how stable the borders and limits are. Gamers test responsiveness and resilience; they explore the stable and unstable system states of the entire interparadigmatic issue and thus construct a theory of stability, based on their experiences when gently deflecting several parts of the system—parts that might be represented by other role-players to some degree.

Multiperspectivism

Figure 1 is amended to show in Figure 6 its application for a new type of developmental studies, implemented as the master’s curriculum GS (2011) at Graz University in Austria since 2010, with an intercultural and developmental focus (Fowler & Pusch, 2010; Freire, 1993; Hofstede, de Caluwé, & Peters, 2010; Hofstede, Hofstede, & Minkov, 2010).

Multiperspectivism is a necessary means of incorporating all possible views into a holistic concept in order to strengthen the tissue of understanding. If understanding of the related different values is included, interparadigmatic means seeing and assessing complex issues such as GC both through the lenses of different disciplines and from the standpoints of different cultures (far left in Figure 6).

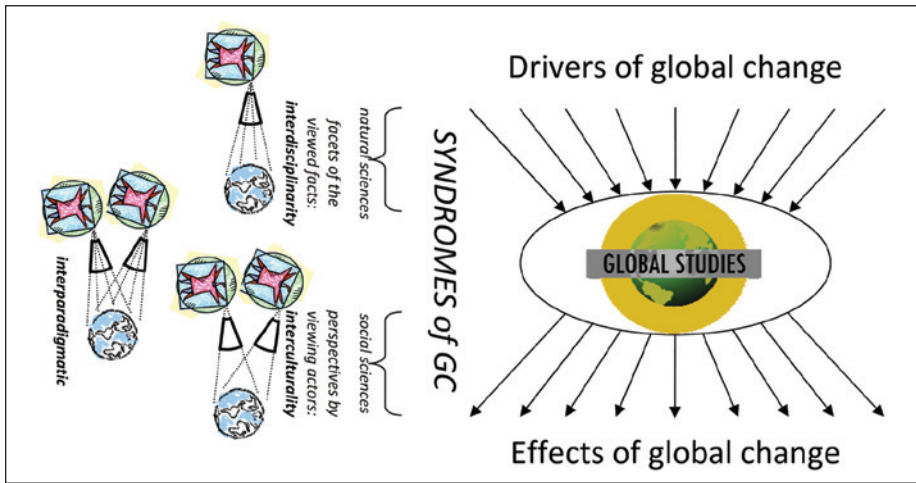


Figure 6. The reality of global change (right, symbolized by the logo of Global Studies in Graz, Austria) has produced the notions of interdisciplinary, intercultural, and interparadigmatic thinking, learning and acting (left).

Seen from the perspective of trainers and learners, the bundle of formerly cognition-centered targets is enriched. Participants find targets, form teams, give and receive feedback, reflect, and gradually improve their own and others' pieces of work.

Rhythmization

The practical question in gaming is "How to navigate between all these roles and procedures?"

Ideally, a player is enabled to assume all (or at least sufficiently many) multiperspectivistic states during the game procedure. A *rhythm* can allow for a guided procedure that facilitates the players' personalities to adapt from one role's framework conditions and required actions to others.

In addition, when taking into account the diverse *learner types* among gamers, rhythmization is a helpful structure in order to provide recurring opportunities to "glue into reality" (double interact according to Klabbers, 2003, p. 577). Another key aspect is the mutual inner linkage (even conquering) of the paths that run through at the different levels (each having an own score), as shown at right in Figure 5. This state of being *tragically knotted* into life (reminiscent of classical Greek dramas) characterizes any living, and hence learning, situation. A game designer should aim for suitably loose, but still guiding framework conditions for the players.

Rhythmization may occur along space and time, but also regarding opinions, perspectives, and human interaction and it appears to be a central element of game design. Design of consensus is at the core of what a gaming procedure intends.

The practical meaning of these above-generalized criteria is therefore to (compare Kolb & Kolb, 2009)

- create and organize a team (social self-organization)
- find and report scientific, technical, and political information (academic research)
- list and weigh the principal effects of a professional project (assessment)
- prepare the team's standpoint on the basis of collected material (argumentation)
- defend the team's standpoint in a discussion (implementation)
- try to create consensus between several actors based on arguments

Experience from schools and politics tells us that in many cases learning does not occur when it was initially intended and scheduled, but occurs as a *side effect*, when learners strive for something else—possibly for succeeding in gaming. A game designer should consequently strive for recurring and suitable framework conditions, triggers, and recurrent constellations of roles acting as teasers that take the learner into the stream of autopoietic restructuring of his or her own consciousness and worldview. Rhythmization of communicative framework conditions provides such variety (see later in Figure 10).

One and Many: Understanding and Acting

In a nutshell, it is proposed that the procedural design of gameplay facilitates the following four principal types of procedures:

- First on an individual level (*one*): (ω) analytic and (α) dialogic procedures
- Second on a team level (*many*): (ω) analytic and (α) dialogic procedures

These 2×2 principal types of communicative action are similar to a set of playing cards in a card game that consists of four main types of cards combining the instances of numbers and colors: both the *one* and the *many* of both understanding (ω) and acting (α).

Figure 7 proposes a generalized pattern of procedures along which simulation games can proceed: Simple and complex (i.e., *one* and *many*) exercises of both understanding and action contribute to a wealth of communicational situations that graphically consist in a loop, which means that procedures will start anew and with a higher level of structural buildup.

Interestingly, such a fundamental pattern of societal structuration has been found to occur along global trends of long-term techno-socioeconomic evolution (*macrolearning*, see Figure 4 below), and is intentionally used in the web-based negotiation game SGC (*microlearning*) for which several types of graphic notation have been developed (Ahamer, 2010, see Figure 10 at right). Game design allows that both the implementation of (α) and (ω) is possible during a dynamic learning process in an equilibrated way.

In practice, learners are seen to have differing profiles in a number of respects (intellectual, social, self-esteem, communicational, etc.). This need can either be met by

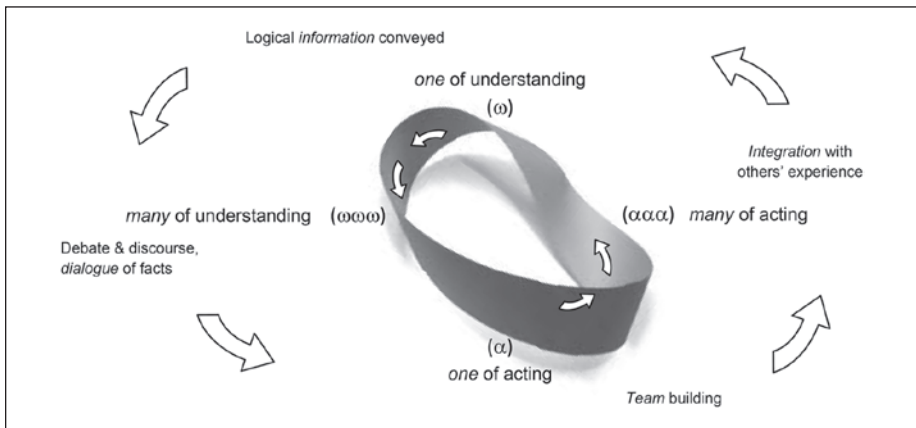


Figure 7. A proposed generalized procedure along a set of four communicational unit patterns (ω , $\omega\omega\omega$, α , $\alpha\alpha\alpha$).

Note: The Möbius band symbolizes the dynamics of the four basic dimensions of gaming: both the *one* and the *many* of understanding and of action.

computerized autoadaptive learning (e.g., Lazcorreta, Botella, Fernandez-Caballero, & Gascuena, 2006) or by a dialogic structure into which learners are immersed in several levels of SGC (Ahamer, 2008b), using the example of international negotiations.

One additional quality criterion for effective learning procedures (in the sense of actually changing behavior) is that it is effective for diverse learners' profiles. The dynamic process above allows them to lock into a wide variety of learning frameworks and situations.

As a consequence, any learning endeavor should provide a sufficient number of *docking stations* for their multidimensional profiles, according to the symbol in biochemistry, where meeting antigens and antibodies may successfully react only if their geometric profiles are similar (Schönborn, Bivall, & Tibell, 2011).

Constructing Consensus Means to Change Climate Change

The Case of SGC

Following the above-mentioned generalized criteria, the author has invented a web-based negotiation game named "SURFING GLOBAL CHANGE" (SGC), implemented three dozen times at several Austrian universities according to the normative description of rules published earlier in this journal (Ahamer, 2006).

SGC ranges from "punctual and partial arguments" to "integrated organisms of argumentative views"; hence, it ascends from a single-perspective worldview to a multiperspective worldview.

Practically, supported by a web-based structured communication system for concrete documents, SGC participants are trained to

- express their view
- take note of others' views
- understand that any point of view has its pros and cons and take into consideration such fact-based differences in views
- appreciate that the relative weighing of partial arguments is an important step

Design of consensus building is the larger purpose of SGC. From this perspective, gaming has the same focus: It is an instrument for identifying societal consensus.

The pedagogic outlay of SGC aims at balancing competition versus consensus, self-study versus team work, consolidating one's own standpoint versus readiness to compromise, deconstruction into details versus integration into a whole, and thus seeks to mirror professional realities. To this end, the architecture of SGC provides a framework for game-based learning along five interactive game levels (Figure 8):

1. learn content and pass quizzes
2. write and reflect about a personal standpoint
3. win with a team a competitive discussion
4. negotiate a complex consensus between teams
5. integrate views when recognizing and analyzing global long-term trends



Figure 8. The structure of the web-based negotiation game SGC (after Ahamer, 2006).
Note: SGC = SURFING GLOBAL CHANGE.

The detailed rules are copyrighted by the author and can be read in Ahamer (2006); the rules are not repeated here.

What Does It Mean to Design a Set of Rules?

Analyses show that there can be a discrepancy between the two following functionalities of rules:

- Rules in a course should translate with high-fidelity students' activities into appropriate marks (according to a set of previously defined and hopefully generally accepted criteria for good work like depth of research and analysis, clear understanding of the issue, appropriate argument fostering one's own standpoint, and quality of the presentation).
- Rules in a game should optimally enable a suitable dynamic of the activities and the social processes by maximizing the number of events that enable students to actively learn.

All in all, the above dilemma is equivalent to the tension between attempted justice and attempted pragmatic functioning of a society. Therefore, the process of inventing and implementing this game SGC is a fine example in a nutshell of how boundary conditions for positive development of a society can be defined. Practical personal, societal, political, and pedagogical experience shows that *rules* are circumvented in almost all cases. Gaming in general (hence also SGC) represents rare cases of a self-referential didactic setup that uses even the effects of circumvention of rules for achieving practical solutions.

Each rule is immediately avoided and circumvented. Each theory-based explanation of reality is immediately confuted and disproved: such is the character of dynamic self-referential evolution—but this is not ethical inferiority. Rather, this dynamic trait can help to unmask built-in offsets, for example, regarding climate protection versus (economic) development, or regarding market instruments versus directive measures or strategic offsets.

Graphical Representations for Social Procedures in Gaming

The dynamic and self-referential social procedures arising from the SGC set of rules can be graphically represented in different ways while keeping in mind that social processes occur at several levels of reality simultaneously (Figure 5 at right). Graphical methods have often been advocated to systemically describe highly complex social procedures in order to highlight the system's overall dynamic behavior (Eisenack, 2005; Eisenack & Petschel-Held, 2002).

Some examples for *graphons* are displayed in Figure 9 (Ahamer & Jekel, 2008), these timelines of selected social and behavioral parameters provide a valve-like graphical representation of an opposed pair of framework conditions for gaming, similar to an air flow through a jet engine.

Another, more differentiated graphical representation is designed to resemble *musical scores for social procedures* (Ahamer, 2010, p. 279) for the typical dynamics of the above-mentioned parameters “one of understanding” (ω), “many of understanding” ($\omega\omega\omega$), “one of acting” (α), and “many of acting” ($\alpha\alpha\alpha$) during SGC gameplay are displayed in Figure 10 at right (for details, see Ahamer, 2010, pp. 281-292).

Observation shows that the following generalized social activities exhibit a maximum one after the other: understanding single facts (ω), understanding opposing perspectives of the same facts mediated through a dialogue ($\omega\omega\omega$), team building (α), and understanding

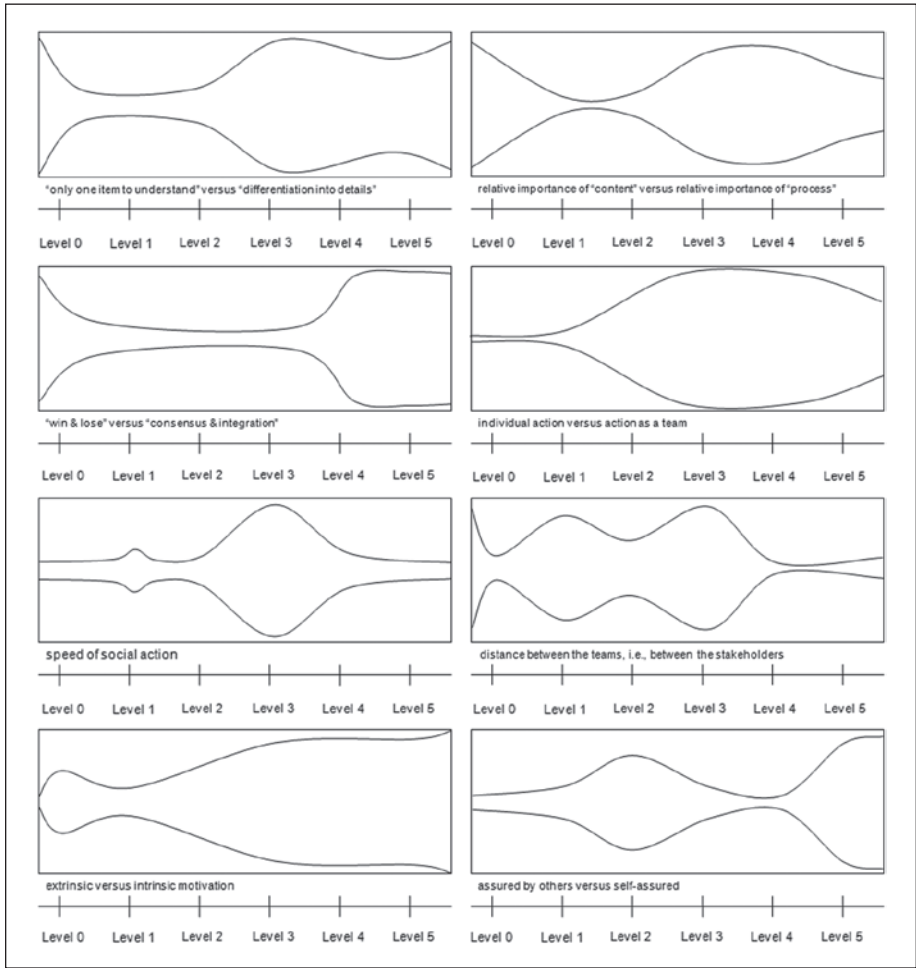


Figure 9. Graphons describe the change of several pairs of antagonizing social parameters during gameplay.

Note: The first described parameter denotes the upper and lower section of the horizontal axes, and the second denotes the inner section of the horizontal axis.

the appropriateness of worldviews that oppose one's own ($\alpha\alpha\alpha$). Based on earlier experience (Ahamer, 2010a; USW, 2012), this sequence ($\omega-\omega\omega\omega-\alpha-\alpha\alpha$) is considered a suitable sequence in (e)Learning.

The choice for the SGC set of rules represents the allowance of a *strategy* $\omega-\omega\omega\omega-\alpha-\alpha\alpha$ where team building is crucial for the integration of opinions into a consensus (compare Harteveld & Bekebrede, 2011). This strategy means that first, discussion should take place and second, team structures will grow by themselves (not the other way round, as is often the case in simulation games).

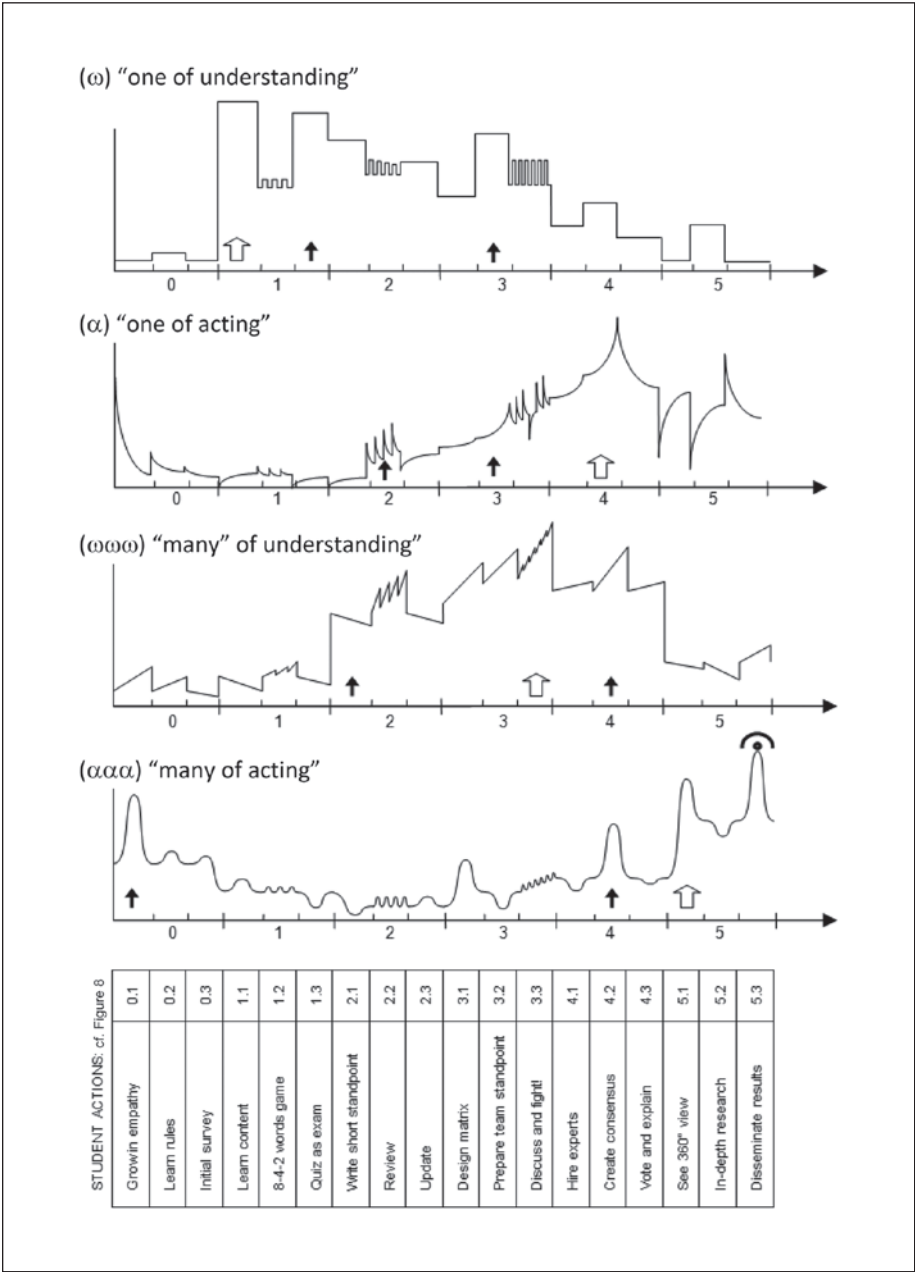


Figure 10. Musical scores depicting the social process flow in SGC.

Source: Ahamer (2010, in press).

Note: SGC = SURFING GLOBAL CHANGE.

At any rate, practical experience does not show that individual learning leads directly to integration of complementary worldviews, but it must be mediated by social processes such as taking roles and becoming a member in diverse action groups. Only dialogue and discourse allow understanding. Therefore, the conclusion for building up suitable climate change institutions is made: If institutions are conceptualized and structured in a nondialogic manner (e.g., in a hierarchical manner), they could be seen as structurally suited in a suboptimal manner for responding to climate change. Dialogic cultures (such as parts of the Anglo-Saxon culture) seem to be structurally better adapted to responding to climate change.

Integration occurs only via dialogic interaction. This justifies dialogue as the main didactic principle (Burbules & Bruce, 2001), favors a participatory framework against a programmatic framework (Russ, 2010), and recalls also the standpoint of the American pragmatic philosopher John Dewey (Berding, 2000; Halliwell, 2005; Meadows, 2006) who saw dialogue as an elementary process in learning.

Perception of complexity is a societal task and a social process: It is helpful to describe and visualize. Visualizing allows understanding more instantaneously—notably when visualizing pertains not only to the geometric or geographic space, but to the *space* of opinions, roles, perspectives, visions, and paradigms. This is the approach of SGC, first using tables and web postings for each role as physical correlate and substrate, later on players become independent of such auxiliary means. Therefore, this article proposes also to visualize complex patterns in the spaces of communication, argumentation, roles, perspectives, and viewpoints; first attempts are proposed in Figures 9 and 10. *Space* is understood as a framework of orientation for social processes that uses unit dimensions peculiar to all social (learning) processes.

Consequently, the art in simulation/gaming is to arrange the (individual or even global) social procedures in a way so that they give rise to an optimal learning effect, that is, changed behavior, such as the institutionalization of IPCC and UNFCCC, in some views, has done in the past on a global level.

The very background of inventing the present system of rules is the question: “How can social procedures be organized in such a way that fact-based quality of complex results is safeguarded or enhanced?” Based on a decade of experience (especially with SGC on the individual level), this article underlines the need for further transposition of individual practical real-world dialogue processes onto the global level in order to provide successful societal learning for the entire human civilization, notably how to react to GC.

Conclusion

This article condenses only the most relevant characteristics suggested to pertain to GC, to role-play in response to GC in general and to SGC specifically. This article sets out to combine conclusions drawn from the articles listed in the appendix and therefore suggests the following concluding statements:

1. Analyze system properties of GC.
2. Derive quality criteria for GC simulation games.
3. Suggest the web-based negotiation game SGC as a template for web-based, structured, rhythmized, and role-based discourse.
4. Propose graphical means to describe social dynamics when gaming on several levels.

The following conclusions are proposed to characterize suitable gaming for GC:

- a. The structure of GC is such that opposing views on causes and effects have to be taken into account (multiparadigmatic approach) in order to increase acceptance.
- b. Understanding GC and withstanding GC are to be balanced.
- c. Coevolution of facts and the values for assessment of facts create shifting fundamentals and moving targets that hamper the approaches of traditional science. Consequently, this article favors a dialogue-driven consensus approach above a theory-driven programmatic approach (especially given underdeterminism regarding measures, need for decisions under uncertainty, and the high degree of dependence on stakeholders' fundamental economic models).
- d. "Coevolution of problem space and solution space" (as referred to in design science) suggests that gamers learn most when assuming opposing roles throughout gameplay: both author and reviewer, planning actor and affected citizen, active discussant and reflecting bystander. Repeated switching between roles promises to trigger a high learning effect.
- e. As recent transitions have shown, approximation of political and societal systems is possible only through consensus, not through coercion.
- f. Living means learning and creation of structures, most suitably institution building.
- g. GC is typically an underdefined issue (as suggested by design science); hence, strategic approaches should be balanced and inclusive, not exclusive.
- h. Globally changing reality follows what is relevant, not what is logical. GC is a self-referential syndrome of seemingly opposing values (not only of seemingly contradictory facts).
- i. The answer to GC should be a suitable space-time structure of social processes that might best be trained by suitably rhythmized space-time perspectives (hence role structures) of simulation games (which ultimately are defined by their rule design).
- j. *Roles* allow participants to adopt several standpoints at a time and to perceive the several ongoing social processes in an original manner. Roles allow navigating the argumentative landscape. Roles enable an *ethics of negotiation* concept.
- k. Both in reality and in role-play, actions of players mean movements on different layers of social reality at the same time which are intrinsically interlinked

with each other. This makes role-play and simulation gaming a suitable laboratory situation for GC.

- l. In real life, (game) rules are often circumvented—This experience should be made use of when designing rules for the identification of practical solutions.
- m. It seems strategically helpful to make use of climate-friendly global long-term trends such as increased energy efficiency and dematerialization in order to achieve climate protection targets. Therefore, a *Kon-Tiki strategy* of following evolutionary opportunities is suggested.
- n. Because of the complexities described above, graphical representation techniques for these processes appear useful for describing interaction and systemic interconnectedness.

The conclusion is made thereof: *Gaming serves better than fighting as a GC strategy.*

Based on the above-generalized criteria for gaming related to GC, the web-based negotiation game SGC has been proposed as a case study for gaming to find consensus solutions to which the diverse stakeholders of GC can agree. A plethora of in-depth literature on SGC has been proposed in the appendix for further interest, based on which critical comments are welcome.

Appendix

SURFING GLOBAL CHANGE Bibliography

This appendix lists literature in English that facilitates further studies on SGC. Figure A1 provides a portfolio for a better survey of its concrete content. Additional articles exist in German.

- A. Ahamer, G. (2004a). Negotiate your future: Web based role play. *Campus-Wide Information Systems*, 21(1), 35-58. ISSN 1065-0741. Retrieved from <http://www.emeraldinsight.com/1065-0741.htm> (Outstanding Paper Award 2005).
- B. Ahamer, G. (2006). SURFING GLOBAL CHANGE: Negotiating sustainable solutions. *Simulation & Gaming: An International Journal*, 37, 380-397. Retrieved from <http://www.unice.fr/sg/>; text at <http://sag.sagepub.com>
- C. Ahamer, G., & Schrei, C. (2006). Exercise “technology assessment” through a gaming procedure. *Journal of Design Research*, 5, 224-252. Retrieved from <http://www.inderscience.com/browse/index.php?journalID=192>
- D. Ahamer, G. (2008b). Virtual structures for mutual review promote understanding of opposed standpoints. *The Turkish Online Journal of Distance Education*, 9(1), 17-43. ISSN 1302-6488. Retrieved from <http://tojde.anadolu.edu.tr/>
- E. Ahamer, G. (2010). Heuristics of social process design. In A. Lazinic (Ed.), *Computational intelligence & modern heuristics* (pp. 265-298). ISBN 978-953-7619-28-2, INTECH. Retrieved from <http://www.intechweb.org/>

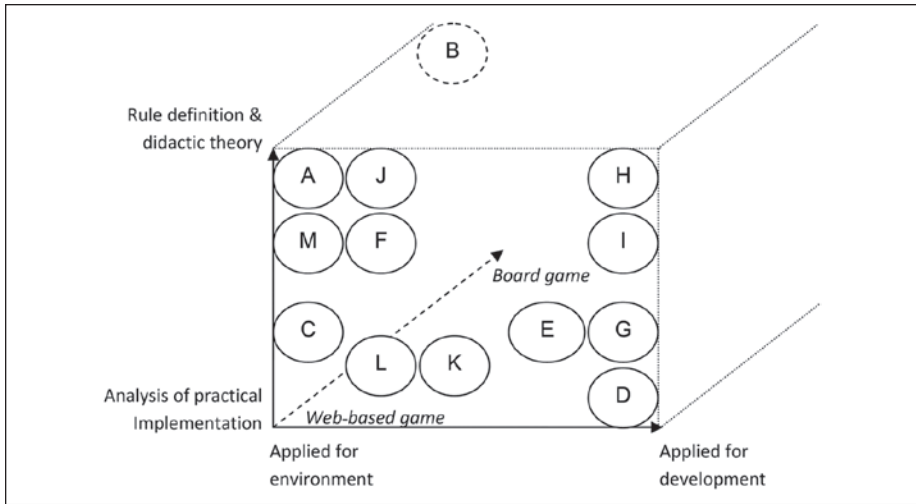


Figure A1. A three-dimensional portfolio for all pieces of literature on SGC in English mentioned here in the appendix.

Note: SGC = SURFING GLOBAL CHANGE.

<http://www.intechopen.com/books/computational-intelligence-and-modern-heuristics/heuristics-of-social-process-design>

- F. Ahamer, G., Car, A., Marschallinger, R., Wallentin, G., & Zobl, F. (2010). Heuristics and pattern recognition for complex geo-referenced systems. In A. Lazinica (Ed.), *Computational intelligence & modern heuristics* (pp. 299-317). ISBN 978-953-7619-28-2, INTECH. Retrieved from <http://www.intechopen.com/books/computational-intelligence-and-modern-heuristics/heuristics-and-pattern-recognition-in-complex-geo-referenced-systems>
- G. Ahamer, G., & Jekel, T. (2010). Make a change by exchanging views. In S. Mukerji & P. Tripathi (Eds.), *Cases on transnational learning and technologically enabled environments* (pp. 1-30). IGI Global, Hershey, New York, Retrieved from <http://www.igi-global.com/bookstore/titledetails.aspx?titleid=37313&detailstype=chapters>
- H. Ahamer, G., & Strobl, J. (2010). Learning across social spaces. In S. Mukerji & P. Tripathi (Eds.), *Cases on technological adaptability and transnational learning: Challenges and issues* (pp. 1-26). Hershey, NY: IGI Global. Retrieved from <http://www.igi-global.com/bookstore/titledetails.aspx?titleid=37311&detailstype=chapters>
- I. Ahamer, G., Kumpfmüller, K. A., & Hohenwarter, M. (2011). Web-based exchange of views enhances "global studies". *Campus-Wide Information Systems*, 28(1), 16-40. Emerald Publishers, ISSN 1065-0741. Retrieved from <http://www.emeraldinsight.com/journals.htm?issn=1065-0741&volume=28&issue=1>

- J. Ahamer, G. (2010a). A short history of web based learning including GIS. *International Journal of Computer Science & Emerging Technologies*, 1(4), 101-111. E-ISSN: 2044-6004. Retrieved from <http://ojs.excelingtech.co.uk/index.php/IJCSET> or directly at <http://ijcset.excelingtech.co.uk/vollissue4/17-vollissue4.pdf>
- K. Ahamer, G. (2011). Localize individuals in spaces of interaction—Analysis of online review processes. *International Journal of Computer Science & Emerging Technologies*, 2(3), 435-454. ISSN 2044-6004. Retrieved from <http://ojs.excelingtech.co.uk/index.php/IJCSET> or directly at [http://download.excelingtech.co.uk/Journal/IJCSET%20V2\(3\).pdf](http://download.excelingtech.co.uk/Journal/IJCSET%20V2(3).pdf)
- L. Ahamer, G. (2011a). IT-supported interaction creates discursive spaces. *International Journal of Latest Trend in Computing*, 2(2), 225-239. ISSN 2045-5364. Retrieved from <http://www.ijltc.excelingtech.co.uk/> or [http://download.excelingtech.co.uk/Journal/IJLTC%20V2\(2\).pdf](http://download.excelingtech.co.uk/Journal/IJLTC%20V2(2).pdf)
- M. Ahamer, G. (2012). The web-supported negotiation game SGC—Rules, history and experiences. *International Journal of Online Pedagogy and Course Design*, 2(2), 60-85. doi:10.4018/ijopcd.2012040105

Declaration of Conflicting Interests

The author declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author received no financial support for the research, authorship, and/or publication of this article.

References

- (See also the literature on SURFING GLOBAL CHANGE [SGC] listed in the appendix.)
- Ahamer, G. (2004). *Structural change in energy economics* (Lecture notes). Graz University. Retrieved from http://www.uni-graz.at/globalstudies/deposit/USW_VisionWirtschaftsEnergiekapitel.pdf
- Ahamer, G. (2008a). Im Spiegelkabinett unterschiedlicher Entwicklungsvorstellungen [In the hall of mirrors of diverging concepts of development]. *Journal für Entwicklungspolitik*, 24(3), 56-76. Retrieved from <http://www.mattersburgerkreis.at/jep/20083.php#ahamer>
- Ahamer, G. (in press). *Mapping global change*. Series *environmental protection*. Dordrecht, Netherlands: Springer.
- Ahamer, G., & Jekel, T. (2008, September 22-24). *GIS educates for integrated assessment*. EESD 2008—Engineering Education in Sustainable Development—International Conference, Graz. Available from <http://eesd08.tugraz.at/>
- Argyris, C. (1993). *Knowledge for action: A guide to overcoming barriers to organizational change*. San Francisco, CA: Jossey-Bass.
- Argyris, C., Putnam, R., & McLain Smith, D. (1985). *Action science, concepts, methods, and skills for research and intervention*. San Francisco, CA: Jossey-Bass. Retrieved from <http://actiondesign.com/resources/research/action-science>

- Argyris, C., & Schön, D. (1978). *Organizational learning: A theory of action perspective*. Reading, MA: Addison-Wesley.
- Badke-Schaub, P. (2004). Strategies of experts in engineering design: Between innovation and routine behaviour. *Journal of Design Research*, 4(2).
- Bauer, J. (2007). *Prinzip Menschlichkeit – warum wir von Natur aus kooperieren* [The humanity principle—Why we are co-operating by nature]. Hamburg, Germany: Hoffmann und Campe.
- Berding, J. W. A. (2000). *John Dewey's participatory philosophy of education—Education, experience and curriculum*. The History of Education and Childhood, Nijmegen University. Retrieved from <http://www.socsci.kun.nl/ped/whp/histeduc/misc/dewey01.html>
- Bots, P. W. G., Wagenaar, F. P., & Willemse, R. (2010). Assimilation of public policy concepts through role-play: Distinguishing rational design and political negotiation. *Simulation & Gaming: An International Journal*, 41, 743-766.
- Brown, H., & Ciuffetelli, D. C. (Eds.). (2009). *Foundational methods: Understanding teaching and learning*. Toronto, Ontario, Canada: Pearson Education.
- Burbules, N. C., & Bruce, B. C. (2001). Theory and research on teaching as dialogue. In V. Richardson (Ed.), *Handbook of research on teaching* (4th ed., pp. 1102-1121). Washington, DC: American Educational Research Association. Retrieved from <http://faculty.ed.uiuc.edu/burbules/papers/dialogue.html>
- Castells, M. (2001). Bausteine einer Theorie der Netzwerkgesellschaft [Building blocks of a theory of the network society]. *Berliner Journal für Soziologie*, 11, 423-440.
- Cline, A. (2012). *Deontological, teleological and virtue ethics*. Retrieved from http://atheism.about.com/library/FAQs/phil/blfaq_phileth_sys.htm
- Crookall, D. (2009). Evolving. *Simulation & Gaming: An Interdisciplinary Journal*, 40, 290-296.
- Crookall, D. (2010). Serious games, debriefing, and simulation/gaming as a discipline. *Simulation & Gaming: An Interdisciplinary Journal*, 41, 898-920.
- Cynical Geographers Collective. (2011). Measuring impact beyond academic fame: An alternative social impact factor. *Antipode*, 43, 190-194.
- Dewey, J. (1966). *Democracy and education: An introduction to the philosophy of education*. New York, NY: Free Press.
- Eisenack, K. (2005). *Model ensembles for natural resource management: Extensions of qualitative differential equations using graph theory and viability theory* (Doctoral dissertation). FB Mathematics and Informatics, Free University, Berlin.
- Eisenack, K. (2009). Archetypes of adaptation to climate change. In M. Glaser, G. Krause, B. Ratter, & M. Welp (Eds.), *Human/nature interactions in the Anthropocene: Potentials of social-ecological systems analysis* (pp. 107-122). München, Germany: Oekom.
- Eisenack, K., Lüdeke, M. K. B., Petschel-Held, G., Scheffran, J., & Kropp, J. P. (2006). Qualitative modeling techniques to assess patterns of global change. In J. P. Kropp & J. Scheffran (Eds.), *Advanced methods for decision making and risk management in sustainability science* (pp. 83-127). Hauppauge, NY: Nova Science Publishers.
- Eisenack, K., & Petschel-Held, G. (2002). Graph theoretical analysis of qualitative models in sustainability science. In N. Agell & J. A. Ortega (Eds.), *Working Papers of 16th Workshop on Qualitative Reasoning* (pp. 53-60). Sevilla, Spain: Edición Digial@tres.

- Feynman, R. P. (1970). *The Feynman lectures on physics. The definitive and extended edition* (Vols. 1-3). Reading, MA: Addison-Wesley.
- Fowler, S. M., & Pusch, M. D. (2010). Intercultural simulation games: A review (of the United States and beyond). *Simulation & Gaming: An Interdisciplinary Journal*, 41, 94-115.
- Freire, P. (1993). *The pedagogy of the oppressed*. New York, NY: Continuum.
- Global Studies. (2011). *Global studies. Master's curriculum and bundle of electives*. Graz University, Austria, Retrieved from <http://www.uni-graz.at/globalstudies/>
- Greco, M., Branca, A. M., & Morena, G. (2011). An experimental study of the reputation mechanism in a business game. *Simulation & Gaming: An International Journal*, 41, 27-42.
- Halliwell, M. (2005). *The constant dialogue: Reinhold Niebuhr and American intellectual culture*. Lanham, MD: Rowman & Littlefield Publishers.
- Harteveld, C., & Bekebrede, G. (2011). Learning in single-versus multiplayer games: The more the Merrier? *Simulation & Gaming: An International Journal*, 42, 43-63.
- Hense, J., Kriz, W. C., & Wolfe, J. (2009). Putting theory-oriented evaluation into practice: A logic model approach for evaluating SIMGAME. *Simulation & Gaming: An International Journal*, 40, 110-133.
- Herbert, A. (2010). Facilitator, researcher, politician, magician. *Simulation & Gaming: An International Journal*, 41, 681-693.
- Hofstede, G., Hofstede, G. J., & Minkov, M. (2010). *Cultures and organizations, software of the mind: Intercultural cooperation and its importance for survival*. New York, NY: McGraw-Hill.
- Hofstede, G. J., de Caluwé, L., & Peters, V. (2010). Why simulation games work—In search of the active substance: A synthesis. *Simulation & Gaming: An International Journal*, 41, 824-843.
- Jekel, T. (2007). "What you all want is GIS 2.0!"—Collaborative GI based learning environments for spatial planning and education. In A. Car, G. Griesebner, & J. Strobl (Eds.), *GI-Crossroads@GI-Forum* (pp. 84-89). Heidelberg, Germany: Wichmann.
- Kane, S., & Shogren, J. F. (2000). Linking adaptation and mitigation in climate change policy. *Climatic Change*, 45, 75-102.
- Kidder, R. M. (1996). *How good people make tough choices: Resolving the dilemmas of ethical living*. New York, NY: Simon & Schuster.
- Klabbers, J. H. G. (2003). Gaming and simulation: Principles of a science of design. *Simulation & Gaming: An Interdisciplinary Journal*, 34, 569-591.
- Klabbers, J. H. G. (2006). *The magic circle: principles of gaming and simulation*. Rotterdam, Netherlands: Sense Publishers.
- Kolb, A. Y., & Kolb, D. A. (2009). The learning way: Meta-cognitive aspects of experiential learning. *Simulation & Gaming: An Interdisciplinary Journal*, 40, 297-327.
- Kolb, D. A. (1984). *Experiential learning: Experience as the source of learning and development*. Englewood Cliffs, NJ: Prentice Hall.
- Kopainsky, B., Pedercini, M., Davidsen, P. I., & Alessi, S. M. (2010). Blend of planning and learning: Simplifying a simulation model of national development. *Simulation & Gaming: An Interdisciplinary Journal*, 41, 641-662.

- Kriz, W. C. (2000). *Lernziel Systemkompetenz, Planspiele als Trainingsmethode* [Learning target: Systems competency—Simulation games as a training method]. Göttingen, Germany: Vandenhoeck & Ruprecht.
- Kriz, W. C. (2003). Creating effective learning environments and learning organizations through gaming simulation design. *Simulation & Gaming: An Interdisciplinary Journal*, 34, 495-511.
- Kriz, W. C. (2009). Bridging the gap: Transforming knowledge into action through gaming and simulation. *Simulation & Gaming: An Interdisciplinary Journal*, 40, 28-29.
- Kriz, W. C. (2010). A systemic-constructivist approach to the facilitation and debriefing of simulations and games. *Simulation & Gaming: An Interdisciplinary Journal*, 41, 663-680.
- Kriz, W. C., & Hense, J. C. (2006). Theory-oriented evaluation for the design of and research in gaming and simulation. *Simulation & Gaming: An Interdisciplinary Journal*, 37, 268-283.
- Lazcorreta, E., Botella, F., Fernandez-Caballero, A., & Gascuena, J. M. (2006, July 5-7). *Auto-adaptive questions in e-learning system*. Sixth International Conference on Advanced Learning Technologies. Retrieved from <http://www.info-ab.uclm.es/personal/AntonioFdez/download/papers/conference/ICALT2006-ITS.pdf>
- Learning Theories. (2012). *Learning theories: Compilation*. Available from <http://www.learning-theories.com/>
- Meadows, E. (2006). Professional development through teacher inquiry and dialogue: Teachers discuss John Dewey's and their own ideas about education, art, and experience. *Teacher Education and Practice*, 19, 455-471.
- Moser, I., & Moser, F. (2005). *The disappearance of the universe*. Graz, Austria: Zentrum für geistige Heilweisen.
- Nakićenović, N. (1996). Decarbonization: Doing more with less. *Technological Forecasting & Social Change*, 51, 1-17.
- Niebuhr, K. P. R. (1938). *The serenity meme: . . . courage to change what must be altered, serenity to accept what cannot be helped, and the insight to know the one from the other*. Retrieved from http://en.wikipedia.org/wiki/Reinhold_Niebuhr
- Novy, A. (2012). *International political economy*. Vienna, Austria: Center for Latin America studies. Retrieved from <http://www.lateinamerika-studien.at/content/wirtschaft/ipo/ipo-titel.html>
- Oxfam. (1999). *Development and social action. A development in practice reader*. Retrieved from <http://www.scribd.com/doc/53327154/Development-and-Social-Action>
- Reckien, D., & Eisenack, K. (2010). Urban sprawl: Using a game to sensitize stakeholders to the interdependencies among actors' preferences. *Simulation & Gaming: An International Journal*, 41, 260-277.
- Reckien, D., Eisenack, K., & Lüdeke, M. K. B. (2011). Land consumption by urban sprawl—A new approach to deduce urban development scenarios from actors' preferences. *Environmental Modeling & Assessment*, 16, 465-477.
- Reckien, D., Ewald, M., Edenhofer, O., & Lüdeke, M. K. B. (2007). What parameters influence the spatial variations in CO₂ emissions from road traffic in Berlin? Implications for urban planning to reduce anthropogenic CO₂ emissions. *Urban Studies*, 44, 339-355.

- Restrepo, J., & Christiaans, H. (2004). Problem structuring and information access in design. *Journal of Design Research*, 4(2).
- Rogers, C. (1969). *Freedom to learn: A view of what education might become*. Columbus, OH: Charles Merrill.
- Russ, T. L. (2010). Programmatic and participatory: Two frameworks for classifying experiential change implementation methods. *Simulation & Gaming: An International Journal*, 41, 767-786.
- Schönborn, K. J., Bivall, P., & Tibell, L. A. E. (2011). Exploring relationships between students' interaction and learning with a haptic virtual biomolecular model. *Computers and Education*, 57, 2095-2105. Retrieved from <http://urn.kb.se/resolve?urn=urn:nbn:se:liu:diva-68996>
- Simulation & Gaming*. (2012). *Simulation/gaming is to be taken in its broadest meaning. Definition of the scope of the international journal Simulation & Gaming*. Retrieved from <http://www.unice.fr/sg/>
- The Telegraph. (2009, December 9). *Copenhagen summit: Rich nations guilty of "climate colonialism."* Retrieved from <http://www.telegraph.co.uk/earth/copenhagen-climate-change-confe/6771129/Copenhagen-summit-rich-nations-guilty-of-climate-colonialism.html>
- Thomas, J. C., & Carroll, J. M. (1979). The psychological study of design. *Design Studies*, 1, 5-17.
- Umweltsystemwissenschaften*. (2012). *Environmental systems science (= Umweltsystemwissenschaften, USW) at Graz University* (Series of USW Reports). Retrieved from http://www.uni-graz.at/usw1www/usw1www_magazin/usw1www_berichte.htm
- Vogler, R., Ahamer, G., & Jekel, T. (2010). GEOKOM-PEP. Pupil led research into the effects of geovisualization. In T. Jekel, A. Koller, K. Donert, & R. Vogler (Eds.), *Learning with geoinformation* (pp. 51-60). Heidelberg, Germany: Wichmann.
- Welsch, H., & Eisenack, K. (2002). Energy costs, endogenous innovation and long-run growth. *Jahrbücher für Nationalökonomie und Statistik*, 222, 490-499.

Author Biography

Gilbert Ahamer is active at several institutions after having pursued his academic career for several years at an international institute for applied systems analysis. However, he subsequently often struggled with various obstacles in the Machiavellian professional practice of the environmental protection administration in both halves of a reunited Europe. He decided to create a game from his experiences in order to increase slightly the chances of subsequent generations to play with their own future. In an act deviating from a gaming view of life, he has decided to finish studies in Technical Physics, Environmental Protection, and Economics & Business Administration. At present, he learns from students by lecturing at universities. He still attempts to publish his views in interdisciplinary journals instead of spending his spare time taking pleasure in hiking across the changing globe with his family—What an unfortunate decision! Contact: gilbert.ahamer@oeaw.ac.at, gilbert.ahamer@uni-graz.at, gilbert.ahamer@sbg.ac.at, gilbert.ahamer@umweltbundesamt.at, or gilbert.ahamer@chello.at